

Department of Civil, Architectural, & Environmental Engineering
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IM2: A WEB-BASED DATA DISSEMINATION PLATFORM FOR REAL-TIME OBSERVATIONS AND FORECASTS IN COASTAL WATERS

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1. INTRODUCTION

Researchers at Drexel University, Civil and Architectural Engineering and the University of RI, Ocean Engineering and have led a three year (2000 to 2003), National Ocean Partnership Program (NOPP) sponsored study to develop a globally re-locatable, integrated system for real time observation, modeling, and data distribution for shelf, coastal sea, and estuarine waters. Additional partners include the National Oceanic and Atmospheric Administration (NOAA), the Naval Research Laboratory, Brown University, and Applied Science Associates, Inc. The **IM2** system, the web-based component developed at Drexel University, has been applied to Narragansett Bay and RI coastal waters as a demonstration of the practical use of the system to support environmental monitoring, marine pollutant transport and fate, marine transportation, search and rescue operations and to provide a foundation to advance our understanding and predictive capabilities for the bay.

2. PORTAL OVERVIEW

Key Requirements

One of the key requirements was the design of a user friendly portal GUI (Fig. 1). This entailed the need to reduce the number of icons, buttons and activity layers to provide a very short learning curve based on its intuitive structure. In addition, the server-client communication had to be minimized to reduce wait-times on the client site. This led to the adoption of i) data compression techniques to reduce the amount of data being sent over the net, ii) the design of a light weight client structure (time consuming number crunching is carried out on the server site), and iii) the elimination of all repetitive calculations on both the server and client side.

Data Types

The system receives a number of real-time atmospheric and oceanographic data components that are collected by measurement stations

(Narragansett Bay PORTS and RIDOT), and forecasts that are generated through numerical models (Applied Science Assoc. BFHYDRO for oceanographic, and the National Ocean Service's CSD-Lab NBLAPS, NBMM5, and ETA12 models for meteorological data).

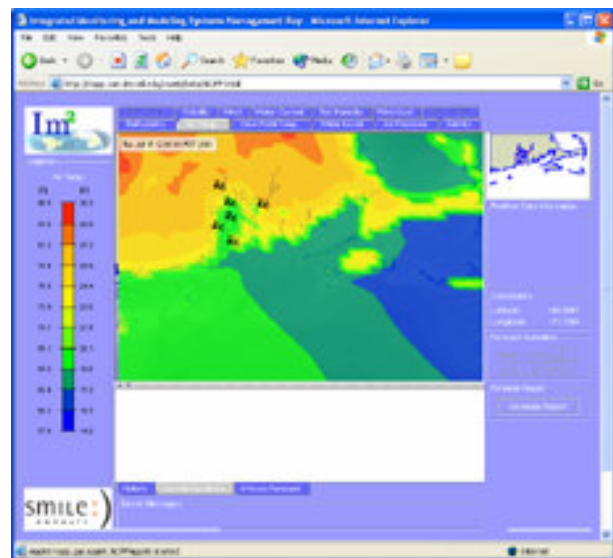


Figure 1 IM2 User Interface showing Air Temp.

The selection of data types includes Wind Speed, Air and Dew Point Temperature, Visibility, Air Pressure, Relative Humidity, Currents, Salinity, Water Temperature, Wave Height, and Water Elevations, which were identified as the most desirable during a user survey conducted at the beginning of the project.

Data Display

Real-time data streams from measurement stations like buoys are displayed in a report that shows the current state of all variables at that station as well as a time series of the variables. Alternatively, for a selected variable a time series history can be displayed for any of the selected stations in the domain. Contour plots can be generated for the variables that are produced by the numerical models because of their high spatial resolution in addition to vector plots for wind and

currents (Fig. 2). In addition, the contour and vector plots can be animated to show forecast predictions, that are available for up to 36 hours.

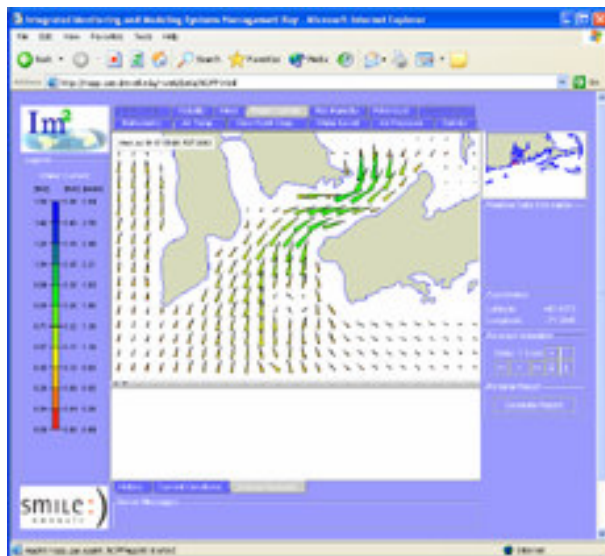


Figure 2 Example of Vector Plot for Zoom Area

3. PORTAL ARCHITECTURE

IM2 Software Components

IM2 was developed around the paradigm of a globally re-locatable system that would be operating system independent and based on largely public domain software components. It is constructed using SUN Microsystems public domain JAVA SDK version 1.4.1_02, and runs the MySQL public domain data base, along with the APACHE 2.0.40 Web server and the Jakarta TOMCAT 5.0.1 servlet engines on a DELL Precision 630 (533 MHz Pentium III processor speed and 1GB of RAM) operating under Red Hat LINUX version 9.0. The second (data processing) server of the system is a SUN 280R dual 1020 MHz SPARCIII (64 bit) processor machine that serves as the “number crunching” workhorse of the **IM2** system and that also handles the data backup.

Data items are either “pulled” (netCDF files from the CSD-Lab server every 12 hours) or “pushed” (from the URI Coastmap server every 6-10 minutes and ASA BFHYDRO server every 24 hours) in a predefined and simple data format. All of the processes (retrieval and processing) are fully automated and run in the background. The data and corresponding data description files are stored in the file system of the server for easy access and minimized overhead. The system is built for expansion and adaptability by using a small set of

configuration files that control the functionality and appearance of **IM2**. This feature enables the system to be adopted for any number of variables and makes it extremely flexible for future applications. Finally, the system makes use of the JAVA 2 Virtual Machine, which has become standard (via Plug-In from SUN) for the two most popular web browser, MS Explorer and NetScape, the only software requirement on the client side.

META-Data

The server processing module creates two file sets: the META-data files (coded up using the Extensible Markup Language, XML) containing the data set descriptions, and the data files themselves. The applet/server communication is based entirely on the information stored in the META-data files. These are parsed by servlets after which the requested data files are identified and sent to the applet on the client.

The underlying META-data standard for this system is the Dublin Core META-data Initiative (DCMI), which can be found at <http://dublincore.org/>. The DCMI standard was used because of its concise and small set of mandatory data description elements that could easily be implemented and adapted for the **IM2** system. The current set contains only a few extensions (primarily for the description of time series) to fully cover the entire underlying data population which are in compliance with the extension rules set forth by DCI.

The system can easily be configured to receive data from other large data repositories like the National Water Information System (NWIS) of USGS. Plans are under way to make **IM2** a client that can tie into the National Virtual Ocean Data System (NVODS) through the netCDF interface.

4. ACKNOWLEDGEMENTS

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